Clio: A 5 μm Camera for the Detection of Giant Exoplanets

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We are in the process of building a thermal infrared (3–5 μm wavelength) coronograph, Clio, to image giant exoplanets around nearby, Sun-like stars. We have targeted the 3–5 μm region to take advantage of the unprecedented combination of low thermal background and high resolution provided by the 6.5-m MMT's adaptive secondary mirror. The current status of the instrument, preliminary analysis of speckle noise at the MMT, and simulations modeling the exoplanet detection probability will be presented. In order to properly quantify the detection limits of Clio, we will collect data that allows us to include the full effect of speckle noise at the MMT. These results will then be included in a series of Monte Carlo simulations to calculate the number of expected exoplanet detections, given a set of assumed separation and mass distribution functions. Starting with distribution functions extrapolated from radial velocity results and using our current detection limit estimates, we expect to detect 14 ± 3companions with 5–15 $M_{Jupiter}$ at 13–50 AU for a sample of 80 M0–F0 stars within 20 parsecs and less than 1 Gyr old. Our sample has also been constructed so that a non-detection will allow us to put valuable constraints on the actual distribution functions for giant exoplanets. With knowledge of the prevalence and distribution of giant exoplanets, we can begin to understand to what extent such planets may disrupt or provide a hospitable environment for terrestrial planets in the habitable zone of the systems.